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Understanding large-scale energy flows through end-to-end shelf ecosystems - the importance of physical context

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Abstract

A major feature distinguishing shelf ecosystems is the physical context defining rates of nutrient import, nutrient recycling, and plankton exchange between the shelf and ocean. To understand the roles of food web structure and physical context in controlling ecosystem dynamics, we applied a standardized end-to-end model platform to four shelf ecosystems: upwelling, downwelling, offshore bank, and semi-enclosed basin. Two-dimensional geometry and a monthly climatological time-scale were used to consider low-frequency, macro-scale dynamics. Comparative analyses of four different food webs within each physical setting tested the null hypothesis that when nutrient input and physical factors are standardized, there are no substantial differences in the productivity of similarly defined guilds within diverse food webs. With a few specific exceptions, physical context played the greater role in defining ecosystem dynamics, especially at lower trophic levels. Exchange between shelf and ocean affected not only nutrient recycling but also trophic transfer efficiencies and the relative importance of pelagic vs. benthic